CTBTO
PREPARATORY COMMISSION

SnT 2019

CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

24 TO 28 JUNE

HOFBURG PALACE
VIENNA, AUSTRIA

CONFERENCE GOALS

1. To broaden and strengthen the engagement of the scientific communities working in test ban monitoring, including young scientists, and to enhance the geographic and gender representations of these communities
2. To support the exchange of knowledge and ideas between the CTBTO and the broader scientific community
3. To identify opportunities and possible solutions to continuously improve nuclear test monitoring and verification
4. To identify how scientific developments and cooperation can support national needs and frame policy objectives in support of the CTBT
5. To promote the wider civil and scientific applications of techniques and data used for test ban verification

CALL FOR PAPERS

Deadline for submission of abstracts:
31 JANUARY 2019 at 23:59 UTC

INVITATION

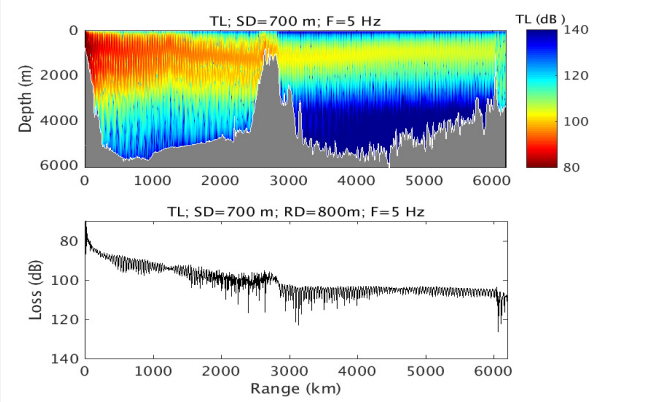
The Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) relies on innovation to enhance the capabilities of the Treaty's verification regime as well as to help move the Treaty closer to universalization and entry into force.

As the seventh event in the CTBT: Science and Technology conference series, SnT2019 will bring together around 1000 scientists, technologists, academics, students, CTBTO policy makers, members of the media and representatives of organizations involved in research and development that is relevant to all aspects of Treaty verification.

CTBTO.ORG/SnT2019
#SnT2019

THEME 1

THE EARTH AS A COMPLEX SYSTEM



Prediction of sound propagation in the ocean with complex two-dimensional spatial variations in bathymetry and ocean sound speed profiles over a propagation range of more than 6000 km.

TOPICS

- **T1.1** Atmospheric Dynamics
- **T1.2** Solid Earth Structure
- **T1.3** Properties of the Ocean
- **T1.4** Interaction Among the Earth's Subsystems

This theme focuses on the dynamic or static properties and processes of the earth whose characterization is necessary for the optimum processing, interpretation and assessment of monitoring data. Scientific and technical advances in monitoring the globe for nuclear explosions require an understanding of the way in which features of the earth influence relevant signals as they travel from their point of origin to points where signals are observed.

The signals from monitoring networks, as well as noise recorded by those networks, constitute a massive reservoir of data that can support advances in the earth sciences on a global, regional and local scale. Elements of the monitoring effort also need to be able to consider the complexities of the earth as a social system, specifically the interference between anthropogenic aspects and the earth's system processes, as they are connected and may interact with each other.

One focus continues to be seismic and acoustic wave speed and attenuation, which are essential for locating seismoacoustic disturbances in the earth and its atmosphere and oceans. Another area is atmospheric dynamics relevant to the transport of radionuclides and the propagation of atmospheric infrasound. Yet another area is subsurface properties relevant to the detection of a nuclear explosion by geophysical, radionuclide or other methods during an on-site inspection (OSI). However, relevant characteristics of the earth are not limited to those required for supporting current monitoring technologies. Novel methods of monitoring, including those using satellites or other remote sensing methods, also require characterization of specific properties of the earth's subsystems.

THE VERIFICATION REGIME

The IMS consists of 337 facilities worldwide which monitor the planet for signs of nuclear explosions. Over 90% of the facilities are already in operation, and the IDC in Vienna continuously processes this data stream. Both raw data and analysis results are made available to all 184 States Signatories of the CTBT.

The processing and analysis of data from different sources must ultimately present an integrated picture to assist those who have to decide if an OSI should be conducted in order to clarify whether the Treaty has been violated.

THEME 2

EVENTS AND NUCLEAR TEST SITES

Visit of the CTBTO Youth Group to the former nuclear test site in Semipalatinsk, Kazakhstan, in August 2018.

TOPICS

Events such as earthquakes, explosions and releases of radionuclides produce signals and surface features that may be observed locally, nationally, regionally or globally. Such events can be located in time and space, and their characteristics can be estimated based on the data products collected. This theme covers the characterization of the source, the signals being emitted, and what these reveal about the event and its environment. Only if the source is well characterized can its associated signals and anomalies be correctly analysed and interpreted. To ensure compliance with the Treaty, it is essential to understand the full extent of signals that may be generated by a nuclear explosion, as well as to be familiar with any other seismic, acoustic, radionuclide or other signals that could be confused with those from a nuclear explosion.

The Treaty's provision for OSI depends upon knowledge of the observables that may be expected after a nuclear test and how these could be identified as geophysical, radioactive, temperature or other anomalies or artefacts of testing. While such observations can help distinguish between inactive and active nuclear weapon test sites, the data recorded by International Monitoring System (IMS) stations also make it possible to differentiate nuclear tests from other human made or natural events, thereby serving as a unique reservoir of knowledge for better informed policy making.

One of the challenges facing an inspection team at a historic test site is the need to distinguish and identify observables generated by historic underground nuclear explosions (those conducted before the nuclear testing moratorium) and those resulting from a more recent event. Factors to consider could include recognizing features that may indicate a decommissioned and decontaminated site or those that may suggest an active or reopened site. The types of expertise and capabilities required for these purposes need to be elaborated and could become relevant in the case of any contingency operations that would call upon CTBTO technological capabilities, if requested and if approved by the States Signatories.

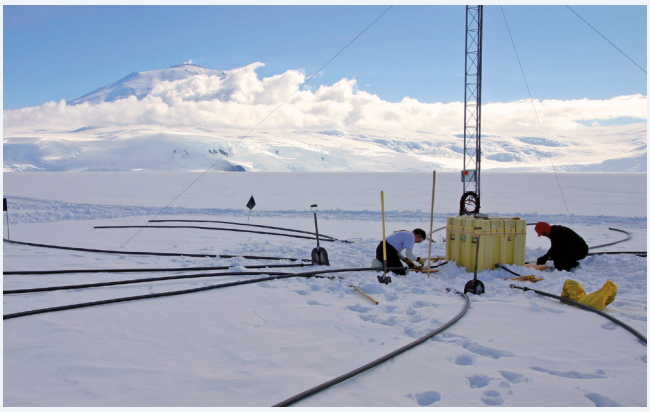
ABOUT THE TREATY

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) opened for signature in 1996. It bans all nuclear explosions, everywhere and by everyone. Before the CTBT can enter into force, all of the 44 countries listed in Annex 2 of the Treaty must ratify it. These countries possessed nuclear power or research reactors when the CTBT was negotiated.

Eight of the Annex 2 States have not yet ratified: the People's Republic of China, the Democratic People's Republic of Korea, the Arab Republic of Egypt, the Republic of India, the Islamic Republic of Iran, the State of Israel, the Islamic Republic of Pakistan and the United States of America.

THEME 3

VERIFICATION TECHNOLOGIES AND TECHNIQUE APPLICATION



Maintenance of infrasound station IS55 in Windless Bight, Antarctica.

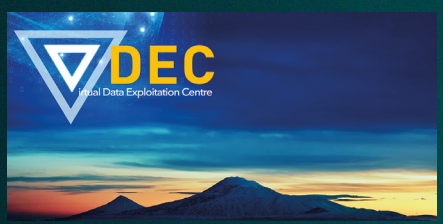
TOPICS

- **T3.1** Design of Sensor Systems and Advanced Sensor Technologies
- **T3.2** Laboratories Including Mobile and Field Based Facilities
- **T3.3** Remote Sensing, Satellite Imagery and Data Acquisition Platforms
- **T3.4** Augmented Reality and Fusion of Data from Different Monitoring Technologies
- **T3.5** Data Analysis Algorithms, Artificial Intelligence, Big Data and Deep Learning

This theme focuses on the systems used for the monitoring of nuclear explosions and the processing of the recorded data. This includes advances in traditional areas such as seismic and radionuclide instrumentation, sensor networks and processing methodologies, as well as the exploration of novel methods and the adaptation and integration of methods used in other fields.

Diverse sources of remotely sensed data, whether from satellites, aircraft or remotely controlled measurement platforms, may find use in nuclear explosion monitoring. OSIs pose special challenges for sensors and associated equipment, which must be capable of detecting observables related to an event that triggered an OSI, especially those related to a nuclear test.

INVITATION TO ACCESS IMS DATA



The virtual Data Exploitation Centre (vDEC) provides scientists with access to IMS data to conduct research and to publish new findings. The strong relationship between the scientific and technological community and the CTBTO helps to ensure that the IMS remains at the forefront of technological innovation and that no nuclear explosion goes undetected. Conference participants are encouraged to make use of vDEC to carry out scientific studies and assessments and to present their findings at **SnT2019.** Requests for access to vDEC can easily be completed and submitted online at **https://www.ctbto.org/specials/vdec/.**

THEME 4

PERFORMANCE OPTIMIZATION

Trainee inspectors conducting a decontamination exercise during the Health, Safety and Security Training Course in Jordan, January 2017.

TOPICS

- **T4.1** Network Optimization
- **T4.2** Systems Engineering
- **T4.3** Enabling Technologies
- **T4.4** Performance of the Full Verification System

Operation and sustainment of a global network of monitoring systems poses substantial challenges. Near real time acquisition and forwarding of continuous and segmented data from the IMS and the subsequent processing and analysis of data at the International Data Centre (IDC) also present great challenges. Strict requirements for operational data availability, quality and timeliness must be met and sustained. The results of processing and analysis raise further issues with regard to quality and timeliness. The handling of OSI data is also subject to specific requirements outlined in the Treaty and the OSI Operational Manual. In addition, the performance of the IMS and IDC critically depends on enabling technologies such as information technology and power systems.

Beyond the IMS, IDC and OSI, the full Treaty verification system also includes National Data Centres (NDCs) and the possible use of non-IMS data to supplement IMS data. NDCs provide advice to their National Authorities, which make decisions in view of a broader policy context. NDCs may have IMS data and Treaty monitoring functions integrated into national operations and procedures to enhance their performance. NDCs provide feedback to the IDC on its products and services, including the NDC analysis tools, and conduct preparedness exercises jointly with other NDCs.

Optimization of the performance of the CTBT verification system involves other factors such as improvements to efficiency and cost effectiveness, reliability, and security. Contributions on improving performance related to the verification system are invited.

REGISTRATION AND SUBMISSION OF ABSTRACTS

Online registration and abstract submission is accessible through **ctbto.org/ SnT2019.** No registration fee will be charged. The working language of the conference is English. Prospective authors are asked to choose the appropriate theme and topic when submitting the abstract (maximum 200 words) of their presentation. Authors can request either an oral or poster presentation. In addition, authors are encouraged to submit a short and very simple description (maximum 280 characters) outlining the abstract's main contribution to the **SnT2019** goals. The selection of abstracts will be based on quality and relevance to the themes and topics of the conference. The Scientific Programme Committee may reassign an abstract to an alternative topic in order to achieve a coherent scientific programme. By submitting an abstract, authors implicitly agree to the publication of their abstract and presentation material by the CTBTO. Accepted abstracts will be made available online and through the mobile CTBTO Events app and compiled into a book of abstracts, and short descriptions may be used on Twitter. A peer reviewed collection of publications will be produced from a selection of all abstracts submitted.

THEME 5

CTBT IN A GLOBAL CONTEXT

The 2nd CTBT Science Diplomacy Symposium in May 2018 included two weeks of dynamic discussions, a high level session with keynote speeches, hands-on simulation exercises and a field trip to the Atominstitut at the Vienna University of Technology.

TOPICS

- **T5.1** Science in Policy Discussions and Lessons Learned from Other Arms Control Agreements and Arrangements
- **T5.2** Experience with and Possible Additional Contributions to Issues of Global Concern such as Disaster Risk Mitigation, Climate Change Studies and Sustainable Development Goals
- **T5.3** Capacity Building, Education and Public Awareness

The CTBTO verification system exists within the broader context of international organizations, global policy making and international collaboration as well as public awareness and safety. This theme explores lessons learned from other arms control agreements and arrangements and from relationships within the broader context as they relate to the CTBT and nuclear explosion monitoring.

Advances in science and technology can drive progress in advising on policies and solutions based on data and evidence and can impact confidence building. This theme explores applications of verification technologies and identifies innovative solutions for change within the framework of the CTBT as well as other relevant agreements and arrangements.

Apart from their purpose of monitoring and detecting nuclear test explosions, IMS data and IDC products may be made available for scientific use, under confidentiality agreements, through the virtual Data Exploitation Centre (vDEC). IMS data may also be used for civil applications, such as nuclear and radiological emergency preparedness and tsunami early warning.

Ensuring that countries and institutions have a robust science–policy interface requires the wide dissemination and appropriate communication of scientific knowledge to both decision makers and the general public. It is therefore important to raise awareness through a broad range of outreach initiatives and science communication.

FINANCIAL SUPPORT

Financial support may be available to a limited number of participants. Such assistance must be requested at the time of registration and **no later than 31 January 2019**.

Financial support will be considered only for participants who have submitted an abstract that is approved by the Scientific Programme Committee. Participants are strongly encouraged to first seek travel and participation funds from non-CTBTO sources.

If you do not find the answer to your questions on the **ctbto.org/SnT2019** pages, please email **SnT@ctbto.org**.

The CTBTO Youth Group is open to all students and young professionals who are directing their careers towards global peace and security and who wish to actively promote the CTBT and its verification regime. Members share the common goal of achieving the entry into force of the CTBT. For more details, email youthgroup@ctbto.org or visit https://youthgroup.ctbto.org/.